istic, giving the general effect. They are good enough for anyone who understands the matter, but not good enough for the student who is trying to master it. But for this minor defect, for which the capable teacher will duly apologize the account of projections is a good one.

It is hard to see why McNair's experiment with falling bodies is described, as it led to nothing. The statement quoted on p. 101, "A party of missionaries bound from China, sailing west, and nearing the [date] line, etc." evidently needs correction, but slips are very rare. The chapter and appendix on the tides are a blemish in the book. They are not needed and could be very well omitted. On pp. 184 and 185 it is asserted—not in these words— that centrifugal forces in the earth developed by its revolution about a common center with the sun [or moon], are less on the side next the sun [or moon] than on the opposite side. It is one of many illustrations of the acute mind of W. M. Davis that he was first to perceive the fundamental importance of the opposite view, as he has explained in Appendix J of his *Physical Geography* (1898), and G. H. Darwin in *The Tides* (1898), p. 98. For the beginner Darwin's introduction of the arrow held parallel to itself while carried about a center is the final touch by which genius lights up darkness. Whoever is interested enough to refer to these authors will perceive that contrifugal forces are to be regarded as equal for all parts of the earth. Rigidly carried out, Professor Johnson's thought seems to give twice as great a tide-raising force on the side of the earth away from the moon as on the one next it, which is not the fact of observation.

The Whewell cotidal chart at p. 186 was discredited by its own author in 1836, as the present reviewer noted in the *National Geographic Magazine* in November, 1898.

If all teachers were competent none of these defects would be serious. As it is too much space has been given to them here. The impression the reviewer would like to convey is that they are the only serious objections that can be found to the work, which is a good one and will be distinctly useful.

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First Principles of Chemistry. By RAYMOND B. BROWNLEE AND OTHERS. Boston: Allyn & Bacon, 1907. Pp. 419.

There is no dispute among science teachers that the study of chemistry is usually difficult for beginners. The reason for this lies in the fact that a certain amount of work must be done before enough facts and fundamental ideas can be presented to the beginner for him to acquire any perspective. For this reason it is of extreme importance that we should put into the hands of the student a textbook which in the first place is written in an easy style; which in the second place at all times keeps well to the prime object of high-school chemistry, viz., the presentation of chemical laws and ideas and their corroboration by means of experiment and illustration; which in the third place holds and stimulates the interest of the reader and brings out the value and importance of the study by referring to practical applications in everyday and industrial life. The textbook by Brownlee and

others fulfils these requirements at every step. This book derives chemical laws in a clear, logical manner; it constantly impresses the reader with the fact that chemistry is a composite whole and not merely a study of a number of scattered facts brought out and illustrated by spectacular experiments.

The method of writing a chemical reaction, indicating by means of an arrow the direction in which the action goes on, is unique and an improvement over the usual method of using equality marks. The idea of an equation is certainly not lost by using the arrow and the advantage gained can easily be noticed when we represent a chemical action which may go in either direction, depending on different physical conditions. For example $n_2\,o_4 \leftrightarrows no_2 + no_2$ according to temperature conditions (chap. xx) or $2So_2 + o_2 \leftrightarrows 2So_3$ (chap. xviii). Again in the discussion of reversible reactions when due to mass action this method of writing is decidedly indicative of actual results.

The tables and lists in the Appendix are perhaps more complete and contain more special information than those found in any other elementary book on the subject.

In general, the book by Brownlee and others inspires better work in chemistry in that it interests the student. It brings out the fundamental ideas on which organic, inorganic, and physical chemistry are based. Chap. xxiii on "Carbon" and chap. xxxv on "Carbon Compounds" form an excellent introduction to organic chemistry. The stress laid on chemical calculations in detail and the full discussions on the metallurgy of metals lay lasting foundations for conceptions of quantitative relations in chemistry. The able treatment of the ionization theory and electrolysis (chap. xv) and the practical applications of these theories in the industrial world (chap. xvi on "Sodium and Potassium Compounds," chap. xxviii on "Copper and Its Compounds" and chaps. xxix and xxxi on the methods and value of gold, silver, nickel, and copper plating) serve to introduce that all-important branch of physical chemistry which we call electro-chemistry. Furthermore, the newest developments of electro-chemistry in connection with the electric furnace are properly shown in chap. xiv on "Sodium and Potassium," chap. xxx on "Aluminum and its Compounds," chap. xxv on "Silicon and Boron," chap. xxiii on "Carbon," with special mention of graphite and carbides. The possibilities, the economy, and the applications of electro-chemistry are admirably treated.

The claims of the authors as stated in the preface are accurately fulfilled. These are: (1) That the experimental evidence precedes the chemical theory and that when sufficient facts have been given to make explanation necessary, generalizations of the science have been introduced, (2) that the historic order is followed in developing the theory, and (3) that the practical aspects of the science are emphasized by giving the pupil some idea of the great commercial importance of chemistry.

Furthermore, the book has many features which make it an interesting text in the hands of the pupil and a valuable assistant to the instructor. Last session six of the reviewer's students became so interested in the book when special discussions were read to them that they borrowed it, "read nearly all of it and found it fine."

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